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THE WORK OF THE HUNTLEY RECLAMATION PROJECT EXPERIMENT FARM IN 1919

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Harvesting Oats on the Huntley Experiment Farm in 1919

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EXTENT AND CHARACTER OF THE WORK.

The work of the Huntley Experiment Farm consists of experiments in the production of crop plants of local importance and also experiments in the feeding and care of live stock. The farm was established in 1909 on a tract of about 300 acres of public land, part of which is irrigated, while part of it lies above the irrigation canal and is used for experiments in the production of dry-land crops. The farm is operated cooperatively by the United States Department of Agriculture and the Montana Agricultural Experiment Station and is under the supervision of the Office of Western Irrigation Agriculture of the Bureau of Plant Industry. The Office of Dry-Land Agriculture, the Biophysical Laboratory, and other offices of the Bureau of Plant Industry as well as the Dairy Division and the Animal Husbandry Division of the Bureau of Animal Industry are cooperating in the investigational work.

The work with live stock was not begun until 1917, when the necessary equipment and stock were provided for carrying on experiments with dairy cattle and hogs.

This report treats of the results of the experiments with irrigated crops and covers some of the results of the pasturing and feeding experiments with live stock.

EXPERIMENTS WITH CROPS.

Experiments with irrigated crops include (1) crop rotation, (2) test of pasture grasses, (3) pasturing tests, (4) cropping methods, (5) tests of crop varieties, (6) experiments with sugar beets, (7) experiments with silage crops, and (8) tests of fruit trees and small fruits.

EXPERIMENTS WITH LIVE STOCK.

The experiments with live stock consist of (1) tests of the carrying capacity of different pasture mixtures with dairy cattle, (2) comparative feeding tests of corn and sunflower silage for dairy cattle, (3) tests of various grain rations supplementary to alfalfa pasture for hogs, and (4) tests of various feeds for finishing hogs in the dry lot. Tests for advanced registry are being conducted with the pure-bred Holstein cattle. In these tests the cows are fed during one lactation period on roughage consisting of grass pasture alone during the growing season of about 5 months and alfalfa hay and silage for the remaining 7 months, and during another lactation period they are fed complete rations of roughage and grains. Not enough of these tests have been completed to make available any data on the comparative production of cows under the two methods of feeding.

In connection with the dairy work, pure-bred bulls, sons of the highest producing cows, are loaned to farmers on the Huntley project under condition that herds in which these bulls are used shall be kept tested and free from disease and also that milk and feed records shall be kept. It is apparent that this feature of the work is much appreciated by local dairymen, and it is thought that this will be a means of increasing interest in dairying and be of much benefit locally in improving dairy stock.

CONDITIONS ON THE PROJECT.

CLIMATIC CONDITIONS.

During the months of April to August, inclusive, the rainfall was only 2.84 inches as compared with 7.56 inches, the normal for the past nine years. The total annual precipitation was 12.22 inches, while the normal for the past nine years was 13.97 inches. During the months of June and July unusually hot weather occurred and a maximum of 107° F. was recorded, which is the highest since the farm was established. The frost-free period extended from May 7 to September 27, or a total of 142 days. The average frost-free period the past nine years was 129 days.

The climatological observations in detail, as recorded during the nine years from 1911 to 1919, inclusive, are given in Table I. The weather record observations were made in cooperation with the Biophysical Laboratory of the Bureau of Plant Industry.

TABLE I.—*Summary of climatological observations made at the Huntley Experiment Farm for the 9-year period from 1911 to 1919, inclusive.*

PRECIPITATION (INCHES).

Item.	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Average for 9 years, 1911 to 1919	0.64	0.23	0.66	0.86	2.21	2.39	1.29	0.81	1.65	1.51	0.86	0.83	13.97
For 1919	.22	.35	.67	.54	.83	.21	.63	.63	2.47	2.61	1.96	1.10	12.22

EVAPORATION (INCHES).

Average for 9 years, 1911 to 1919	.....	.....	.....	3.549	4.818	6.437	7.643	6.763	4.209	.....	.....	.....	32.632
For 1919	.....	.....	.....	5.072	6.454	9.253	9.336	6.932	4.378	.....	.....	.....	41.425

DAILY WIND VELOCITY (MILES PER HOUR).

Highest:													
1911 to 1919	16.5	14.1	13.3	17.8	17.5	10.2	8.6	7.3	10.5	29.4	25.0	26.6	.....
For 1919	13.2	10.1	9.3	13.1	8.8	7.5	6.6	7.3	10.5	29.4	25.0	12.5	.....
Lowest:													
1911 to 1919	.3	.8	.5	1.0	.9	.4	.3	.3	.4	.8	.5	.1	.....
For 1919	2.0	1.5	.8	1.7	2.6	2.7	1.6	1.9	1.5	.8	.5	3	.....
Mean:													
1911 to 1919	5.4	4.7	4.5	5.5	5.1	4.1	3.4	3.3	3.7	4.1	4.4	5.0	.....
For 1919	6.5	4.8	4.5	5.9	4.9	4.4	3.7	3.4	3.9	4.7	6.3	5.1	.....

TEMPERATURE (°F.).

Absolute maximum:													
1911 to 1919	65	63	74	87	99	107	103	100	94	85	71	63	.....
For 1919	65	62	71	79	99	107	102	98	87	80	59	51	.....
Absolute minimum:													
1911 to 1919	−39	−38	−27	12	22	34	38	34	24	−10	−21	−41	.....
For 1919	−16	−13	−11	22	29	34	41	42	28	−10	−20	−41	.....
Mean:													
1911 to 1919	17	21	32	46	54	64	70	68	56	44	33	21	.....
For 1919	33	20	31	47	58	70	73	71	59	35	24	15	.....

KILLING FROSTS.

Year.	Last in spring.		First in autumn.		Frost-free period (days).
	Date.	Minimum temperature (°F.).	Date.	Minimum temperature (°F.).	
1911	May 26	32	Sept. 18	28	114
1912	May 12	28	Sept. 15	31	125
1913	May 5	31	Sept. 19	29	136
1914	May 12	32	Oct. 6	31	146
1915	May 21	32	Sept. 19	32	120
1916	May 16	30	Sept. 13	31	119
1917	May 31	31	Sept. 28	32	119
1918	May 21	32	Oct. 7	28	138
1919	May 7	29	Sept. 27	32	142
Average	May 17	.....	Sept. 17	.....	129

CROP CONDITIONS.

The season of 1919 was unusual in many respects and was rather unfavorable for the growth of some of the farm crops. Conditions of extreme drought prevailed during the growing period and also during the preceding winter, with a consequent shortage of water for

irrigation during a part of the season. Perhaps the greatest loss occurred through lack of sufficient moisture in the soil early in the season to germinate seeds. In ordinary years the natural rainfall is sufficient to start the crops, and irrigation is not necessary until crops are up. Continued drought after the crops were planted made irrigation necessary to provide moisture for germination, which proved to be a difficult operation because of the heavy nature of the soil. This resulted in poor stands of grain crops and entire failure in many cases to secure a stand of sugar beets. The acreage planted to beets was only about half that of former seasons, and the failure to obtain satisfactory stands resulted in a further reduction of about 50 per cent in the acreage. The first and third cuttings of alfalfa were exceptionally good, and although the water shortage reduced the yield of the second crop, the total production for the season was above the average. Unfavorable weather conditions during the fall interfered seriously in the harvest of sugar beets and potatoes, and less than the usual amount of fall plowing was accomplished.

The acreage, yields, and farm values of crops on the Huntley project in 1919 are shown in Table II, the figures being furnished by the United States Reclamation Service.

TABLE II.—*Acreage, yields, and farm values of crops produced on the Huntley Reclamation Project in 1919.*

Crop	Area (acres).	Unit of yield.	Yields.			Farm values.		
			Total.	Per acre.		Per unit of yield.	Total.	Per acre.
				Average.	Maximum.			
Alfalfa hay	7,045	Ton	18,713	2.65	6	$19.66	$367,898	$52.22
Alfalfa seed	146	Bushel	283	.94	10	13.00	3,679	25.20
Apples	12	Box	302	25.16		1.50	453	37.75
Barley	267	Bushel	5,354	20.05	60	1.68	8,995	33.69
Beets, sugar	1,136	Ton	12,015	10.58	20.1	10.00	120,150	105.77
Beets, stock	94		(1)				(1)	
Clover hay	56	Ton	123	2.20	3	13.88	1,707	30.50
Clover seed	188	Bushel	839	4.46	7.5	10.62	8,910	47.39
Corn	179	do	5,046	28.19	60	1.53	7,720	43.11
Garden	176						20,080	114.09
Oats	1,977	Bushel	58,707	29.69	93.5	1.16	68,000	34.40
Pasture, summer	1,389						16,580	11.94
Pasture, winter [2]	16,733						65,834	3.94
Potatoes	40	Bushel	4,781	119.70	300	1.77	8,462	211.55
Wheat	6,518	do	103,149	15.82	64	2.37	244,463	37.51
Miscellaneous	138						6,037	43.75
Oats	52						(3)	
Wheat	146						(3)	
Total	19,310						948,968	
Average								49.14

[1] No yield; no value. [2] Beets, alfalfa, wheat, oats, etc. [3] No crop value; included in above report.

The total cropped area of 19,310 acres remained about the same as in 1918, although the total farm valuation of crops produced was nearly one-fourth higher, due mainly to the increased prices received

per unit of yield. Alfalfa and wheat were the principal crops grown, these two crops occupying more than two-thirds of the total cropped area. While the acreage of sugar beets was low as compared to former seasons, the yield per acre of 10.68 tons was more than 2 tons higher than the yield in 1918. The average farm value per acre of all crops was $49.14, as compared to $39 in 1918.

LIVE STOCK.

The number of cattle, hogs, and sheep kept on project farms in 1919 increased slightly over the previous year, the principal increase being in the number of beef cattle and hogs. The value of hogs, even with the increased number, was less than in 1918, owing to the decline in market values during the latter part of 1919. The total value of all live stock amounted to $73,280 more than in 1918.

Conditions on the project appear to be especially favorable for dairying, although the growth of this industry has been rather slow in recent years, owing to unsettled conditions and unusually high prices received for hay and grain crops. There appears to be a decided tendency for improvement in the grade of dairy stock kept on the project farms, and a few herds of excellent pure-bred Holsteins are being developed.

The total number and value of live stock on the project in 1919 is shown in Table III. This information was furnished by the United States Reclamation Service.

TABLE III.—*Live stock on the Huntley Reclamation Project in 1919.*

Item.	Inventory, Jan. 1.			Inventory, Dec. 31.			Increased or decreased total value.
	Number.	Average value.	Total value.	Number.	Average value.	Total value.	
Horses	2,120	$108.70	$230,435	2,297	$110.00	$252,670	$22,235
Mules	51	107.16	5,465	46	81.50	3,749	− 1,716
Cattle:							
Beef	1,813	51.03	92,517	2,631	47.70	125,498	32,981
Dairy	1,923	60.18	115,726	2,040	62.30	127,092	11,366
Sheep	1,130	13.41	15,153	2,115	8.40	17,766	2,613
Hogs	2,391	18.07	43,205	3,097	13.64	42,242	− 963
Fowls	15,856	.52	8,245	21,456	.66	14,162	5,917
Bees, hives	424	3.78	1,603	458	5.35	2,450	847
Total			512,349			585,629	73,280

CROP-ROTATION EXPERIMENTS.

A rather extensive series of crop-rotation experiments[1] under irrigation was started on 70 quarter-acre plats in field K in 1912, and continued each year since that time without change. Some additional rotations were begun in 1916 on 27 quarter-acre plats in

[1] An outline in detail of the experiments has been given in a previous publication. (See Dept. Cir. 86, entitled "The Work of the Huntley Reclamation Project Experiment Farm in 1918.")

field L–IV. In these experiments seven crops of the most importance locally are grown in various sequences, in eleven 2-year, five 3-year, four 4-year, and six 6-year rotations. In addition, each crop is grown continuously each year on the same plat. The crops grown in these experiments are alfalfa, oats, wheat, sugar beets, potatoes, corn, and flax.

The purpose of these crop-rotation experiments is to determine the effect on crop yields of various crop sequences, to learn the value of alfalfa in a rotation, and to obtain some definite measure of the value of manure when applied to certain crops. Results covering a period of eight years are available from the experiments in field K, and some significant differences in crop yields as a result of the different crop sequences and of the effect of alfalfa and manure are to be noted. There was a wide difference in yields of all of the crops, as shown in Table IV, which gives the maximum, minimum, and average yields of each crop in 1919, as well as the average yield of each crop for the years 1913 to 1918, inclusive. The table indicates that alfalfa gave higher yields when seeded in the fall in grain stubble than when seeded the following spring and that the highest yield occurred the second year after planting.

TABLE IV.—*Average, maximum, and minimum yields of all crops in the irrigated rotations on the Huntley Experiment Farm in 1919, compared with the average yields of the same crops in the 6-year period from 1913 to 1919, inclusive.*

Crop and variety.	Number of plats.	Unit of yield.	Yield per acre.								
			1919			1918	1917	1916	1915	1914	1913
			Maximum.	Minimum.	Average.						
Alfalfa (Montana):											
Spring seeded	5	Ton	2.28	0.47	1.25	2.22	2.03	2.07	2.34	2.22	2.20
Fall seeded	4	...do	2.77	2.40	2.63	3.17	3.42	.....	.....	.....	.....
Second year	9	...do	6.81	4.22	6.09	5.34	5.71	5.26	7.14	5.40	5.85
Third year	5	...do	4.31	4.18	4.24	6.13	5.38	6.26	7.00	5.26	5.35
Continuously cropped	5	...do	6.83	4.61	5.77	5.45	4.65	4.98	4.72	4.62	4.51
Sugar beets (Kleinwanzlebener).	19	...do	15.86	5.75	10.15	12.23	9.82	11.17	9.58	11.16	13.06
Potatoes (Mills Prize)	17	Bushel	389.0	98.1	249.3	367.6	218.2	240.3	301.8	167.8	212.7
Oats (Swedish Select)	21	...do	83.1	22.5	52.7	90.7	75.0	78.2	79.3	89.8	84.2
Wheat (Pringle Champlain)	5	...do	27.3	27.3	27.3	23.9	26.5	26.5	32.3	32.7	27.2
Corn (Northwestern Dent)	8	...do	60.0	22.2	42.7	45.9	32.6	36.3	36.9	42.9	42.0
Flax (Minnesota No. 25)	2	...do	15.6	1.4	8.5	20.2	18.9	17.7	21.3	18.6	21.7

The yields in 1919 of oats, potatoes, and sugar beets in each rotation and the preceding crop are shown in Table V.

The maximum yields of potatoes occurred in rotation 25, which is a 2-year rotation of oats and potatoes in which manure is applied preceding the potatoes. The average yield of two plats of potatoes following oats and manure was 310.6 bushels per acre, while the average yield of two plats of potatoes following oats without manure was at the rate of 249.3 bushels per acre. Five plats following

alfalfa yielded at the average rate of 296.9 bushels per acre. The yield of continuously cropped potatoes was about the same as the yield of potatoes following sugar beets and was less than when preceded by alfalfa, oats manured, or oats without manure. In a 2-year rotation of sugar beets and potatoes in which manure was applied immediately preceding the potatoes the yield was much higher than when potatoes followed beets without manure.

The maximum yield of sugar beets occurred in the rotations in which beets followed potatoes, the average of six plats being at the rate of 11.17 tons per acre. The average yield of sugar beets in three rotations in which beets followed oats and manure was at the rate of 11.08 tons per acre, while in five rotations in which beets followed oats without manure the yield was at the rate of 9.20 tons per acre.

TABLE V.—*Yields per acre of oats, potatoes, and sugar beets with the preceding crops in the irrigated rotations on the Huntley Experiment Farm in 1919.*

Oats.			Potatoes.			Sugar beets.		
Preceding crop.	Rotation No.	Yield.	Preceding crop.	Rotation No.	Yield.	Preceding crop.	Rotation No.	Yield.
		Bushels.			*Bushels.*			*Tons.*
Beets	35	83.1	Oats (manured)	25	389.0	Potatoes	34	15.86
Do	64	76.2	Alfalfa	60	379.7	Oats (manured)	61	13.66
Corn (hogged)	69	73.7	do	61	354.7	Potatoes	35	13.33
Potatoes	60	71.3	do	64	301.0	Beets	2a	12.92
Beets	34	68.7	Beets	20	282.3	Potatoes	21	12.48
Potatoes	61	64.4	Oats	34	258.0	Oats	60	12.02
Beets	22	63.7	Beets (manured)	21	246.6	Flax	67	12.00
Do	46	60.0	Alfalfa	40	246.0	Oats (manured)	23	11.90
Oats	1a	57.5	Oats	24	240.6	Potatoes	64	10.39
Alfalfa	42	57.5	Oats (manured)	35	232.3	Alfalfa	46	9.41
Potatoes	44	54.4	Corn	26	221.6	Oats	32	9.33
Do	25	54.4	Potatoes	4	204.1	do	22	9.28
Corn	16	50.0	Alfalfa	44	203.1	Potatoes	20	8.58
Beets	23	48.1	Potatoes	4a	193.3	Oats	30	7.72
Potatoes	24	41.9	Oats (rye)	27	170.0	Oats (manured)	31	7.70
Do	31	30.6	Beets	30	167.3	Oats	42	7.66
Do	30	26.9	do	31	148.0	Wheat	18	6.47
Corn	32	26.9				Potatoes	40	6.40
Potatoes	27	23.1				Beets	2	5.75
Oats	1	21.9						
Average		52.7	Average		249.3	Average		10.15

SILAGE CROPS.

CORN.

Two varieties of corn, Northwestern Dent and a local Yellow Dent, both early maturing, were grown for silage on 17 quarter-acre plats in fields O–II and O–III. These varieties were selected as being the ones most commonly grown locally. Both varieties were fairly well matured at the time of harvest, September 6, and made silage of excellent quality. The average yield of nine plats of Northwestern Dent corn was at the rate of 9.74 tons per acre

and of local Yellow Dent 8.56 tons per acre. In tests conducted in previous seasons the variety Northwestern Dent has invariably outyielded other varieties of early-maturing corn that have been grown.

Northwestern Dent corn for silage was also grown on 11 quarter-acre plats in field L–II, where the yield was at the rate of 10.39 tons per acre (fig. 1).

SUNFLOWERS.

A test of cultural methods with sunflowers grown for silage which was conducted in 1918 was continued in 1919 with some modifications. Sunflowers of the Mammoth Black Russian variety were grown in rows 20, 30, and 40 inches apart. They were planted on

FIG. 1.—Northwestern Dent corn grown for silage on the Huntley Experiment Farm in 1919.

May 12 with a corn planter, the seed being drilled, the plants in the row averaging about 6 inches apart. The crop required three irrigations. The crop was harvested on August 25, at which time the plants were from one-fourth to one-half in bloom in the different plats. Experience of the previous season appeared to indicate that if harvested when more nearly matured the crop made a silage which was rather hard and woody, and consequently not palatable to stock. The silage made from the crop grown in 1919 appeared to be of better quality than that grown in 1918 and kept in better condition in the silo, although it was not in perfect condition when removed from the silo and was not readily eaten by cattle when fed in a comparative test of corn and sunflower silage. The yields in the 1919 test are given in Table VI, being the average in each case of four one-fourth acre plats.

TABLE VI.—*Yields of sunflowers for silage on the Huntley Experiment Farm in 1919.*

Width of row.	Yield.	
	Pounds per plat.	Tons per acre.
Inches.		
20	14,876	29.75
30	13,875	27.75
40	13,626	27.25

Table VI indicates that the highest yield of 29.75 tons per acre occurred on the plats in which the rows were 20 inches apart, and the lowest on the plats on which the rows were 40 inches apart. Similar results were secured in a similar test in 1918. The silage made from the sunflowers grown in the 20-inch rows was also of better quality, being less coarse and woody.

SUGAR BEETS.

ROOT-LOUSE CONTROL.

An experiment to determine the means of preventing damage to sugar beets by invasion of the beet root louse was continued as in previous seasons, this being the sixth year of the experiment. Varying numbers of irrigations, from two to five, were applied, the plats receiving the larger number of irrigations being irrigated the first time somewhat earlier and the last time later than is commonly done in farm practice. The beet root lice migrate to the beet fields during the early part of July and under favorable conditions enter the soil around the beet roots, where they increase rapidly in numbers and do serious damage to the crop unless they are checked. A dry, cracked soil at this time appears to be favorable to their becoming established. It was the purpose of the experiment to determine whether early irrigation and frequent later irrigations to keep the soil in a moist condition at all times would be effective against the spread of the root lice and in preventing serious damage to the beet crop. In ordinary practice an average of three irrigations is applied to beets, and the first is usually not applied until after the migration period of the root lice.

Drought during the early part of the season made it necessary to irrigate to germinate the seed, which was done on June 1, and also to irrigate all of the plats again on June 23, before thinning. Dates of irrigation after the crop was thinned were as follows: Five irrigations—July 11, 20, and 30 and August 12 and 25; four irrigations—July 11 and 20 and August 5 and 20; three irrigations—July 18 and August 5 and 20; two irrigations—July 25 and August 20.

The yields, amount of infestation, and sugar content of the beets are shown in Table VII.

TABLE VII.—*Yield, sugar content, and percentage of infestation of sugar beets in the root-louse control experiments on the Huntley Experiment Farm in 1919.*

Plat No.	Number of irrigations.	Tons per acre.	Sugar content (per cent).	Infestation (per cent).		Stand (plants per acre).
				Total.	Injurious.	
L-II-9a	5	13.65	16.3	20.19	2.41	16,758
L-II-9b	4	12.74	16.3	23.42	2.0	17,100
L-II-10a	3	13.33	15.7	43.24	7.46	17,127
L-II-10b	2	12.61	16.4	50.82	10.38	16,893
L-II-11a	5	9.46	14.7	11.71	.80	12,060
L-II-11b	4	12.52	14.6	27.23	3.48	14,472
L-II-12a	3	12.27	16.0	48.08	13.31	16,695
L-II-12b	2	13.31	15.2	51.78	12.94	17,658
L-II-13a	5	14.80	15.6	10.02	.31	17,325
L-II-13b	4	13.45	15.0	20.49	2.12	15,678
L-II-14a	3	13.46	12.7	27.89	5.76	15,777
L-II-14b	2	11.49	14.5	43.92	9.19	13,995
L-II-15a	5	8.59	17.4	8.66	.60	13,293
L-II-15b	4	8.87	16.3	10.08	.73	12,222
L-II-16a	3	10.96	14.3	10.69	1.52	13,041
L-II-16b	2	13.91	14.5	24.12	3.58	15,300
Average	5	11.62	16.0	12.64	1.03	.....
Do	4	11.89	15.5	20.30	2.08	.....
Do	3	12.51	14.7	32.47	7.01	.....
Do	2	12.83	15.1	42.66	9.02	.....

The results indicate that the percentage of infestation increased consistently as the number of irrigations was decreased. It is also noted that there appeared to be a decrease in the sugar content in the beets where the percentage of infestation was higher. While the average yield from the plats that received five irrigations was less than on the plats that were irrigated two and three times, it will be noted that poor stands occurred on some of the plats receiving the higher number of irrigations and that if the plats of poor stands are eliminated in considering the results the plats that received five irrigations were highest in yield, while the lowest yield occurred on the plats that received two irrigations. The results in these experiments in previous years appear to indicate that less infestation by the root lice occurs when five irrigations are applied, that the yields are increased, and that the beets that are free from lice invariably contain a larger percentage of sugar.

FRUIT TREES.

Tests of about 50 varieties of apples indicate that only the hardiest varieties will withstand the severe winter conditions and that these hardy varieties make but very slow growth and do not bear fruit for a number of years after planting. In 1919 the Northwestern (*Northwestern Greening*), Patten (*Patten's Greening*), and Wealthy varieties, trees of which were planted in 1911 and 1912, yielded from 10 to 60 pounds per tree, this being the first fruit produced by these trees.

All of the varieties of crab apples that have been tried have proved to be hardy and have borne fruit in four to five years after planting. The varieties that have produced the largest quantity of fruit are the Lyman (*Lyman's Prolific*), Excelsior, and Florence. Trees of these varieties that were planted in 1911 and 1912 yielded from 30 to 50 pounds of fruit each in 1919.

FEEDING EXPERIMENTS WITH HOGS.

The swine-feeding experiments conducted during the season of 1919 were planned to carry on the work outlined in 1917 and 1918, with the addition of a more thorough investigation of the feeding value of barley. This work was conducted in cooperation with the Animal Husbandry Division of the Bureau of Animal Industry.

The pigs used were, with one exception, pure-bred Duroc-Jerseys, all sired by the same boar. One spring pig in the pasturing experiment was a high-grade Duroc-Jersey. The pasture plats were in field A–III, which was seeded in 1916 and used as a hog pasture in 1917 and 1918.

FATTENING FALL PIGS IN A DRY LOT AND ON ALFALFA PASTURE[1]

On July 7, 50 fall pigs, previously on irrigated rotations and dry-land pastures, were divided into six lots and fed barley or corn supplemented with different protein feeds to determine the fattening qualities of the several rations. The experiment extended over a period of four weeks.

Lots 1 to 4 contained three barrows and three gilts each, their average weight being 168 pounds. These hogs were fed in a dry lot on the following rations: Lot 1, barley and skim milk; lot 2, corn and skim milk; lot 3, barley and tankage in the proportion of 10 pounds to 1 pound; lot 4, barley alone.

Lot 5, with seven barrows and six gilts, and lot 6, with six barrows and seven gilts, averaged about 133 pounds per pig. Each lot had access to alfalfa pasture, consuming the equivalent of the second cutting of hay from one-eighth of an acre. Lot 5 received a grain ration of ground barley, and lot 6 received ground barley and tankage fed in the proportion of 10 to 1.

The grain ration was hand fed twice a day, being all that the hogs would eat in 30 minutes. The results are shown in Table VIII.

A comparison of lots 1 and 2 indicates the relative values of corn and barley when supplemented with skim milk. For each pound of gain made the hogs consumed 3.32 pounds of corn and 3.53 pounds of barley. Thus 94 pounds of corn were equal to 100 pounds of barley in this test.

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[1] This report was prepared by Ralph E. Gongwer, who had charge of the animal-husbandry work of the station, being detailed for this work by the Animal Husbandry Division of the Bureau of Animal Industry.

TABLE VIII.—*Results of experiment in finishing fall pigs on various rations supplementary to alfalfa pasture on the Huntley Experiment Farm in 1919.*

Items of comparison.	Lot 1, barley, skim milk.	Lot 2, corn, skim milk.	Lot 3, barley, 10 pounds; tankage, 1 pound.	Lot 4, barley.	Lot 5, barley, alfalfa pasture.	Lot 6, barley, 10 pounds; tankage, 1 pound; alfalfa pasture.
Duration of experiment.....days..	28	28	28	28	28	28
Number of pigs in lot.....	6	6	6	6	13	13
Daily feed, consumption:						
Grain, per hundredweight...pounds..	3.26	2.89	3.6	3.5	3.64	3.72
Milk.....do....	5.75	5.62	.....	.....	.....	.....
Average weight:						
Initial.....do....	167.3	169.8	166.8	167.2	134.2	132.3
Final.....do....	216.2	216.8	209.8	207.5	166.7	163.5
Daily gain.....do....	1.74	1.68	1.54	1.44	1.16	1.13
Total feed consumed:						
Grain.....do....	1,034	935	1,115	1,080	1,964	1,964
Skim milk.....do....	1,821	1,821	.....	.....	.....	.....
Feed consumed per pound of gain:						
Grain.....do....	3.53	3.32	4.32	4.46	4.65	4.84
Skim milk.....do....	6.22	6.46	.....	.....	.....	.....

Lots 1, 3, and 4 show the value of barley supplemented with skim milk, compared to barley with a tankage supplement and barley fed alone. Barley and skim milk produced the most rapid gains, but barley and tankage proved to be the most economical ration when the value of the skim milk consumed in lot 1 is considered. A ration of barley alone made the slowest gains and required the most grain per unit of gain.

Lots 5 and 6 are not comparable to the first four lots, as the pigs were smaller and were somewhat stunted, due to running on dry-land pastures just previous to the experiment. Lots 5 and 6 gained at about the same rate, but the barley and tankage lot required 18 pounds more feed to produce 100 pounds of pork. The addition of tankage to the ration also increased the cost of the feed in lot 6 over that in lot 5 on barley alone.

Barley and tankage fed in the proportion of 10 pounds to 1 pound produced the cheapest gains of any ration fed and were only slightly below the barley or corn plus the skim-milk ration with respect to rapidity of gains. Tankage was unnecessary in a ration of barley when the pigs had access to good alfalfa pasture.

FATTENING FALL PIGS ON ALFALFA PASTURE.

Two lots of 11 hogs each were placed on two quarter-acre plats of alfalfa on May 15, and remained for a period of 35 days. Lot 1 received a full feed of ground barley and lot 2 a full feed of shelled corn, in order to test the relative merits of the two feeds for fattening purposes. The results obtained are noted in Table IX.

The gains besides being more rapid in the corn-fed lot were also made with less grain and hay, 77 pounds of corn producing as much

pork as 100 pounds of barley with 21 per cent less hay. These results indicate that for a short, quick finish on alfalfa pasture, corn produces pork more rapidly and economically than barley.

TABLE IX.—*Comparison of barley and corn for fattening fall pigs on alfalfa pasture on the Huntley Experiment Farm in 1919.*

Items of comparison.		Lot 1, barley.	Lot 2, corn.
Initial weight:			
Total, on May 15	pounds	1,449	1,450
Average per pig on May 15	do	131.7	131.8
Final weight:			
Total, on June 19	do	1,933	2,063
Average per pig on June 19	do	175.7	187.5
Total gain	do	484	613
Average daily gain, 35 days	do	1.26	1.59
Feed consumed:			
Total grain	do	2,219.5	2,153.2
Daily grain per hundredweight of body	do	3.71	3.46
Feed consumed per pound of gain:			
Grain	do	4.59	3.51
Hay equivalent	do	.62	.49

COMPARISON OF BARLEY AND CORN FOR BROOD SOWS WITH SUCKLING PIGS.

On April 1, 11 pure-bred Duroc-Jersey sows with pigs of an average age of 2 weeks were divided into two lots as nearly equal in total weight and number of pigs per lot as was possible. Both lots were fed equal quantities of skim milk, and each sow received 2 pounds of mill feed and one-quarter pound of tankage per day. Lot 1 received in addition a grain ration of ground barley in comparison with lot 2 receiving a grain ration of corn. Sufficient grain was fed to keep the sows from losing too much flesh. The experiment covered a period of five weeks.

On May 14, four sows were divided into two lots as nearly equal in total weight as was possible when leaving an equal number of pigs in each lot. These two lots, 3 and 4, were grazed on two quarter-acre plats of alfalfa, the crop being nearly 12 inches high when the sows and pigs were turned on. Lot 3 received a 2 per cent ration of barley and lot 4 a 2 per cent ration of corn to supplement the pasture. The experiment extended from May 14 to June 11. The results obtained in these two tests are combined in Table X.

Comparing lots 1 and 2, the results show that a heavier ration was required to maintain weight in the sows fed with corn than in those fed with barley, a 1.92 per cent ration of barley equaling a 2.18 per cent ration of corn. Although the pigs running with the sows that were fed corn gained more rapidly, more grain was required to produce a pound of this gain.

In lots 3 and 4 a 2 per cent grain ration failed to prevent severe loss in weight of the sows while on pasture, and the daily loss for the corn-fed sows was almost twice as great as for the barley-fed lot. In this case the pigs in lot 3 fed on barley gained more rapidly than

those in lot 4, or 0.62 pound per day per head compared to 0.38 pound per day per head. The loss in weight of the two sows on alfalfa pasture plus a 2 per cent ration of corn was so great that it outweighed the gain in weight of the pigs, showing a net loss of 9 pounds. The 2 per cent ration seemed to be inadequate for their needs. In lot 3 on the barley ration the sows maintained their weight better, the pigs gained more rapidly, and less grain was required per unit of gain.

TABLE X.—*Comparison of barley and corn when fed in a dry lot and on the alfalfa pasture for brood sows with suckling pigs on the Huntley Experiment Farm in 1919.*

Items of comparison.	Lot 1, barley.	Lot 2, corn.	Lot 3, barley.	Lot 4, corn.
Dry-lot period ... days	35	35	.....	.....
Pasture period ... do	.....	.....	28	28
Number of sows	5	6	2	2
Number of pigs	38	41	15	15
Total initial weight:				
Sows ... pounds	1,871	2,057	678	734
Pigs ... do	318	380	264	152
Total final weight:				
Sows ... do	1,780	1,959	592	565
Pigs ... do	899	1,088	496	312
Average daily weight:				
Loss per sow ... do	.52	.46	1.53	3.02
Gain per pig ... do	.44	.49	.62	.38
Total weight, sows and pigs:				
Initial ... do	2,189	2,437	942	886
Final ... do	2,679	3,047	1,088	877
Gain ... do	490	610	146	9
Feed consumed:				
Skim milk ... do	2,450	2,450	.....	.....
Mill feed ... do	350	420	.....	.....
Tankage ... do	43.75	52.5	.....	.....
Alfalfa pasture (hay equivalent) ... do	.....	.....	600	600
Grain ... do	1,642.5	2,096	372	387
Grain per hundredweight, sows ... do	1.92	2.18	2.02	2.00
Grain consumed per pound of gain:				
Sows and pigs ... do	3.35	3.44	2.55	(1)
Pigs alone ... do	2.81	2.96	1.60	2.42

[1] No gain.

The results are corroborated by a test conducted at this station in 1917. In two lots of two sows each, one lot fed corn and the other fed barley and both grazing on alfalfa pasture, a pound of gain was produced in the pigs with 2.18 pounds of barley while 2.5 pounds of corn were required.

Considering these facts, it was found that for a brood sow with suckling pigs, whether in a dry lot or on alfalfa pasture, a barley ration seemed to maintain a more uniform weight in the sows and produce cheaper gains on the pigs than corn.

VARYING GRAIN RATIONS FOR SPRING PIGS ON ALFALFA PASTURE.

Eight lots of eight pigs each, as nearly uniform in age, weight, and breeding as possible to select, were placed on alfalfa pasture on June 17 for a period of 99 days. Lots 1, 2, and 3 received corn at the rate of 1 per cent, 2 per cent, and 3 per cent, respectively, of the body weight per day; lot 4 received corn from a self-feeder; lots 5, 6,

and 8 received ground barley at the rate of 1 per cent, 2 per cent, and 3 per cent, respectively, of the body weight per day; and lot 7 received no grain. All lots were on divided pasture with the exception of lot 5, and all lots grazed quarter-acre areas except lot 7, which grazed half an acre. The results are noted in Table XI.

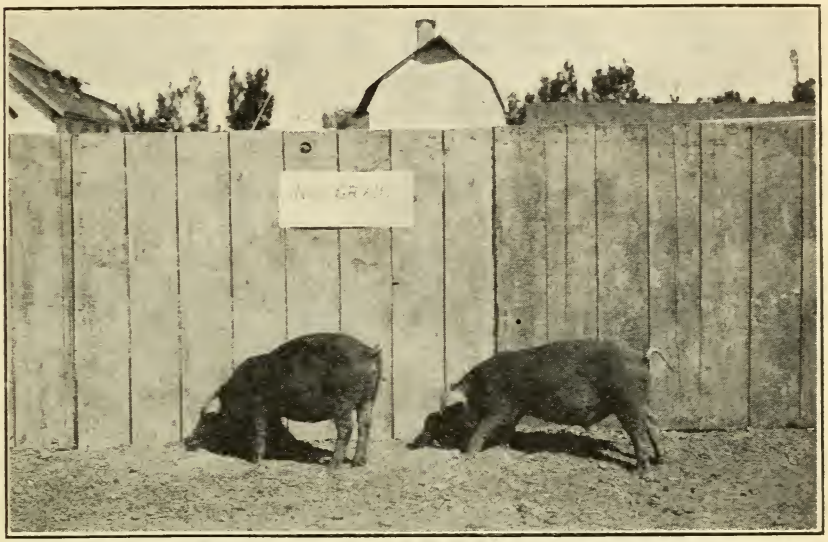

FIG. 2.—"No grain" spring pigs at the end of the pasture season, average weight 63.6 pounds, on the Huntley Experiment Farm in 1919.

TABLE XI.—*Feeding varying grain rations to spring pigs in lots of eight each on alfalfa pasture on the Huntley Experiment Farm in 1919.*

[Area of pasture for lot 7 one-half acre, for all other lots one-fourth acre each.]

Items of comparison.	Lot 1, 1 per cent corn.	Lot 2, 2 per cent corn.	Lot 3, 3 per cent corn.	Lot 4, self-fed corn.	Lot 5, 1 per cent barley.	Lot 6, 2 per cent barley.	Lot 7, no grain.	Lot 8, 3 per cent barley.
Average weight, per pig:	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*	*Pounds.*
Initial, June 17	40.1	40.5	40.2	40.1	41.0	40.8	40.5	40.6
Final, September 24	63.6	71.5	108.8	139.2	60.0	71.9	53.1	90.0
Daily gain	.236	.313	.693	1.001	.192	.314	.128	.499
Pork produced per acre	748	992	2,196	3,172	608	996	202	1,580
Feed consumed per pound of gain:								
Grain	2.18	3.54	3.00	3.23	2.63	3.41	.....	3.66
Hay equivalent[1]	4.33	3.27	1.48	1.02	5.33	3.25	16.00	2.05

[1] The yield of hay was estimated from two check plats yielding at the rate of 3,240 pounds of hay per acre in the last two cuttings.

Table XI shows that the rate of gain increases with the amount of grain fed. Lot 7, receiving no grain, made an average daily gain of 0.128 pound per pig, while the grain-fed lots increased in daily gain as the grain ration increased up to 1 pound per day in the self-fed lot. (See figs. 2 and 3.)

The grain required per pound of gain was highest in the 3 per cent barley lot. In the lots fed barley the least grain was required to

produce a pound of pork in the 1 per cent lot, followed in turn by the 2 per cent and the 3 per cent lots. In the lots fed corn, the 2 per cent lot made poor gains and hence required the largest weight of corn per pound of gain. Aside from this lot, the corn-fed lots arranged themselves, as did the barley-fed lots, with respect to grain consumed per pound of pork produced, the self-fed lot requiring the most grain and the 1 per cent lot the least grain.

The amount of pasture consumed per pound of gain, reduced to a hay basis, decreased with each increase in the grain fed. This was true both in the barley and in the corn fed lots. This experiment

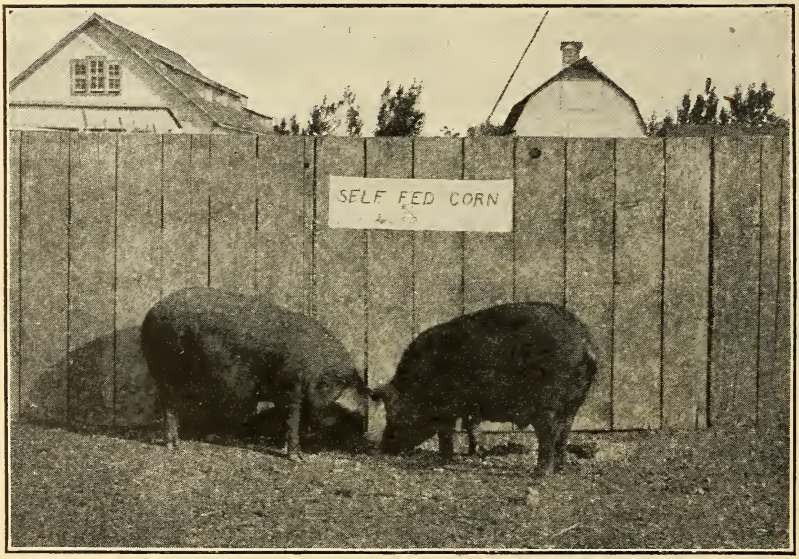

FIG. 3.—Spring pigs on alfalfa pasture and self-fed corn at the end of the pasture season, average weight 139.2 pounds, on the Huntley Experiment Farm in 1919.

also affords a comparison of the value of corn and barley as supplements to alfalfa pasture between lots 1, 2, and 3, fed corn, and lots 5, 6, and 8, fed barley. The average of these three comparisons shows that 90 pounds of corn are equal to 100 pounds of barley.

DRY-LOT PERIOD.

An accurate conception of the relative values of these various grain rations on alfalfa pasture is obtained after the pigs have reached a marketable weight. This necessitates a dry-lot finishing period for all lots.

Six representative pigs were selected from each lot and placed in a dry lot on September 25. Each lot was fed all the alfalfa hay that the pigs would consume, also ground barley and tankage in a self-feeder, mixed in the proportion of 10 pounds of barley to 1 pound of tankage. The results are noted in Table XII.

TABLE XII.—*Dry-lot period spring pigs in lots of six each fed on a varying grain ration on the Huntley Experiment Farm after the pasture season of 1919.*

Items of comparison.	Lot 1, 1 per cent corn.	Lot 2, 2 per cent corn.[1]	Lot 3, 3 per cent corn.	Lot 4, self-fed corn.	Lot 5, 1 per cent barley.	Lot 6, 2 per cent barley.	Lot 7, no grain.	Lot 8, 3 per cent barley.
Dry-lot period.....days..	85	73	62	41	78	76	105	56
Average weight per pig:								
Initial, September 25, pounds.....	68.7	78.2	103.7	133.0	65.8	70	56.7	98.5
Final.....pounds..	181.7	186.6	196.2	198.5	182.7	174.0	200.0	193.3
Daily gain.....do....	1.33	1.48	1.49	1.60	1.50	1.37	1.36	1.69
Total feed consumed:								
Grain.....do....	3,506	2,764	2,780	1,926	3,763	3,315	4,581	2,912
Hay.....do....	55	33	30	10	57	54	27	59
Grain fed per pound of gain.....do....	5.17	5.10	5.01	4.90	5.37	5.31	5.33	5.12

[1] One pig developed hernia and was removed from the lot. Correction has been made for the grain consumed.

During the dry-lot period there was very little choice between the eight lots in the rate of gain and in the feed consumed per unit of gain. The most rapid gains were made in lot 8, 1.69 pounds per pig per day, and the lowest gains were in lot 1, 1.33 pounds per pig per day. The grain required per pound of gain was highest in lot 5, 5.37 pounds, and the lowest in lot 4, 4.90 pounds. All lots made reasonable gains and none of the pigs appeared to be stunted or unthrifty due to their limited grain ration during the pasture season. The results from the pasture and dry-lot periods are combined in Table XIII.

TABLE XIII.—*Spring pigs, in lots of eight each, on alfalfa pasture with varying grain rations and in a dry lot on the Huntley Experiment Farm in 1919.*

[Area of pasture for lot 7, one-half acre, for all other lots one-fourth acre each.]

Items of comparison.	Lot 1, 1 per cent corn.	Lot 2, 2 per cent corn.	Lot 3, 3 per cent corn.	Lot 4, self-fed corn.	Lot 5, 1 per cent barley.	Lot 6, 2 per cent barley.	Lot 7, no grain.	Lot 8, 3 per cent barley.
Pasture period.....days..	99	99	99	99	99	99	99	99
Dry-lot period.....do....	85	73	62	41	78	76	105	56
Total.....	184	172	161	140	177	175	204	155
Weight per pig:								
Initial.....pounds..	40.1	40.5	40.2	40.1	40.0	40.8	40.5	40.6
At end of pasture season.....pounds..	63.6	71.5	108.8	139.2	60.0	71.9	53.1	90.0
At beginning of dry-lot season.....pounds..	68.7	78.2	103.7	133.0	65.8	70.0	56.7	98.5
Final.....do....	181.7	186.6	196.2	198.5	182.7	174.0	200.0	193.3
Daily gain.....do....	.74	.86	1.00	1.18	.77	.77	.76	.93
Total feed consumed:								
Grain.....do....	5,083	5,300	5,349	5,130	5,417	5,264	6,108	5,329
Hay and hay equivalent.....pounds..	883	863	850	823	886	882	1,656	889
Feed consumed per pound of gain:								
Grain.....pounds..	4.66	4.75	4.15	3.90	4.98	4.87	4.89	4.62
Hay.....do....	.81	.77	.66	.62	.81	.82	1.33	.77

The average grain consumption per pound of gain for all lots on pasture, exclusive of lot 7, was 3.18 pounds. For the dry-lot period the same figure for all lots was 5.19 pounds. The chief advantage then would seem to be in making as much growth as possible on

pasture and reducing the length of the expensive dry-lot period. This is shown in Table XIII. Lot 4, in a dry lot only 41 days, produced a pound of pork with 3.90 pounds of grain during the combined periods. Lot 7, in a dry lot 105 days, required 4.89 pounds of grain to make 1 pound of pork for the two periods even when credited with 101 pounds of pork produced on pasture with no grain charge.

Lot 4, self-fed corn, required the least grain and the least hay and pasture to produce a pound of pork. The 3 per cent corn and the 3 per cent barley lots followed in the order named in economy of gains.

A comparison of the corn-fed and the barley-fed lots would be of more value if the difference in feeds had been continued during the dry-lot period. Lots 1, 2, 3, and 4 received barley after the first 56 days of the experiment. Comparing lots 1, 2, and 3 with lots 5, 6, and 8 in Table XIII, the corn-fed pigs made a pound of pork with 0.3 pound less grain and 0.05 pound less hay.

AVERAGE RESULTS, 1917, 1918, AND 1919.

The results obtained in this experiment over a period of three years, with corn as the varying grain ration, on alfalfa pasture, are compiled in Table XIV. The conditions each year were similar to those described for 1919.

TABLE XIV.—*Results of feeding spring pigs on alfalfa pasture and in a dry lot on the Huntley Experiment Farm averaged for 1917, 1918, and 1919.*

Items of comparison.	No grain.	1 per cent corn.	2 per cent corn.	3 per cent corn.	Self-fed corn.
Area of pasture ..... acres	0.50	0.25	0.25	0.25	0.25
Number of pigs	8	7⅓	8	8⅔	8⅓
Pasture period ..... days	85	85	85	85	85
Dry-lot period ..... do	132	121	105	84	70
Total ..... do	217	206	190	169	155
Weight per pig:					
Initial ..... pounds	38	37	38	38	38
At end of pasture season ..... do	48	55	67	90	122
At beginning of dry-lot season ..... do	50	57	68	89	120
Final ..... do	187	182	193	201	203
Gain per pig:					
Total ..... do	147	143	154	164	167
Daily ..... do	.68	.70	.81	.97	1.08
Total feed consumed:					
Grain ..... do	5,615	5,022	5,698	5,915	5.561
Hay or hay equivalent ..... do	2,878	1,445	1,209	1,466	1,498
Feed consumed per pound of grain:					
Grain ..... do	4.75	4.78	4.63	4.16	4.00
Hay ..... do	2.44	1.37	1.07	1.03	1.08

Table XIV shows that the average daily gain per pig in the lots receiving no grain, 1 per cent corn, 2 per cent corn, 3 per cent corn, and self-fed corn was 0.68 pound, 0.70 pound, 0.81 pound, 0.97 pound, and 1.08 pounds, respectively, for the combined pasture and dry-lot periods. The weights of grain required per pound of gain for the

same periods and lots were 4.75, 4.78, 4.63, 4.16, and 4.00 pounds, respectively. The weights of hay and hay equivalent required per pound of gain for the same periods and the same lots were 2.44, 1.37, 1.07, 1.03, and 1.08 pounds, respectively.

With these figures, the result of experimentation for three years with 121 hogs as a basis, it may be said:

(1) That the heavier the grain ration fed to spring pigs grazing on alfalfa pasture the more quickly they reach a marketable weight.

(2) That the hay and pasture required per pound of gain decreased with an increase in the grain ration on pasture, with the exception of a slight increase in the self-fed lot over the 2 and 3 per cent lots.

(3) That aside from the fact that the pigs fed no grain required 0.03 pound less grain for the entire period than those fed with a 1 per cent ration to produce a pound of pork, the larger the amount of grain fed while on pasture the less grain was required to grow a hog to a marketable weight.

CROP-UTILIZATION EXPERIMENTS.

PASTURING ALFALFA WITH HOGS.

In rotation 67, field K, and in rotation 69, field L–IV, two quarter-acre plats of third-year alfalfa are pastured by hogs. The pasturing season is divided into two periods: May to June, inclusive, the spring period, and July to October, the summer period. Fall pigs are used during the first period and spring pigs during the second. The pigs are put on at the rate of 2,000 to 2,500 pounds per acre.

Each plat is divided into two equal areas and the hogs alternated from one pasture to the other each 9 to 12 days, depending upon the growth of the alfalfa. This arrangement allows the hogs fresh pasture at regular intervals and makes irrigation more convenient. The hogs are weighed each 14 days. With these weights as a basis the hogs are fed a supplementary ration of shelled corn at the rate of 2 pounds daily per 100 pounds live weight.

The results obtained from pasturing alfalfa with hogs for the years 1913 to 1919, inclusive, are shown in Table XV.

TABLE XV.—*Results of pasturing pigs on alfalfa on the Huntley Experiment Farm during the 7-year period from 1913 to 1919, inclusive.*

[Calculations reduced to an acre basis. As only the third crop of alfalfa was pastured in 1913, the results for that year are not used in determining the averages.]

Year.	Rotation No.	Number of pigs.		Number of days.	Pigs (weight in pounds).				Grain fed per pound of gain.
		Spring.	Summer.		Initial.	Final.	Gain. Total.	Gain. Average daily per pig.	
1913	67	.....	48	41	2,788	3,624	836	0.50	2.65
1914	67	16	36	138	3,272	5,572	2,300	.42	2.78
1915	67	20	32	150	4,364	6,840	2,476	.70	3.13
1916	67	20	32	145	3,520	6,552	3,032	.85	2.79
1917	67	16	36	150	3,280	5,460	2,180	.74	2.87
1917	69	20	32	152	3,288	5,768	2,480	.72	2.64
1918	67	20	32	148	3,200	5,560	2,360	.66	2.72
1918	69	20	32	148	3,216	5,464	2,248	.63	2.85
1919	67	20	32	159	3,720	6,196	2,476	.57	2.99
1919	69	20	32	161	3,700	5,796	2,096	.48	3.43
Average	.....	19	33	150	3,057	6,912	2,405	.64	2.91

HOGGING-OFF CORN.

The spring pigs used to pasture the alfalfa in rotation 67, field K, are used to hog-off the corn in the same rotation in the fall. The hogs are put on the plats of mature corn at the rate of 1,000 to 1,500 pounds per acre.

Table XVI gives the results obtained from hogging-off corn for the eight years 1912 to 1919, inclusive, reported on an acre basis.

TABLE XVI.—*Results of hogging-off corn on the Huntley Experiment Farm during the 8-year period from 1912 to 1919, inclusive.*

[Calculations reduced to an acre basis.]

Year.	Number of hogs.	Number of days.	Weight (pounds).					Estimated yield.
			Hogs.			Pork per acre per day.	Grain fed per pound of gain.	
			Initial.	Final.	Total gain.			
								Bushels.
1912	20	16	2,900	3,288	388	24.2	5.3	36.4
1913	16	23	1,312	2,280	768	33.3	4.4	60.0
1914	16	22	1,380	2,276	896	40.7	3.2	50.4
1915	16	25	1,376	2,240	864	32.6	4.5	52.4
1916	16	20	1,516	2,188	672	33.6	5.0	60.0
1917	16	24	1,200	1,828	628	25.2	3.8	43.2
1918	16	27	1,428	2,152	724	26.8	5.1	65.0
1919	16	27	1,636	2,112	476	24.1	4.1	55.0
Average	16.5	23	1,594	2,293	677	30.1	4.4	52.8

HOGGING-OFF CORN AND RAPE.

In rotation 69, field L–IV, Dwarf Essex rape is drilled between the corn rows about the last of July at the rate of 8 pounds per acre. By the time the corn matured the rape had made a good growth. The hogs were removed from the alfalfa pasture in the same rotation and put on the corn and rape plats. Table XVII presents the results obtained from pasturing corn and rape during the 4-year period from 1916 to 1919.

TABLE XVII.—*Results of hogging-off corn and rape on the Huntley Experiment Farm for the 4-year period from 1916 to 1919, inclusive.*

[Calculations reduced to an acre basis.]

Year.	Number of hogs.	Number of days.	Weight (pounds).					Estimated yield.
			Hogs.			Pork per acre per day.	Grain fed per pound of gain.	
			Initial.	Final.	Total gain.			
								Bushels.
1916	8	38	660	1,246	586	15.42	4.85	50.8
1917	16	22	1,168	1,700	532	24.18	4.33	41.1
1918	16	35	1,156	1,964	808	23.10	3.80	55.0
1919	16	29	1,116	1,930	814	48.06	2.41	60.0
Average	14	31	1,025	1,710	685	27.69	3.85	51.7

Comparing the average results for eight years of hogging-off corn without rape with the average of four years of hogging-off corn and rape, there seems to be a slight advantage in favor of the corn and rape. This is shown in Table XVIII.

TABLE XVIII.—*Comparison of results of hogging-off corn for four years with rape and for eight years without rape on the Huntley Experiment Farm.*

[Calculations reduced to an acre basis.]

Item of comparison.	Average results.	
	Eight years without rape.	Four years with rape.
Number of hogs per acre	16.5	14
Duration of experiment ... days	23	31
Total weight:		
Initial ... pounds	1,594	1,025
Final ... do	2,293	1,710
Gain ... do	677	685
Pork per acre per day ... do	30.1	27.7
Yield of corn (estimated) ... bushels	52.8	51.7
Estimated grain fed per pound of gain ... pounds	4.4	3.85

HOGGING-OFF CORN WITH AND WITHOUT TANKAGE.

In order to test the value of tankage as a supplementary feed for hogs used in hogging-off corn, two lots of eight pigs each were placed on two 1-acre plats of corn, and one lot was given free access to tankage in a self-feeder. The results are presented in Table XIX.

TABLE XIX.—*Comparison of results in hogging-off corn, with and without tankage, on the Huntley Experiment Farm in 1919.*

Items of comparison.	Lot 1, corn alone.	Lot 2, corn and tankage.
Area of pasture ... acres	1	1
Number of hogs	8	8
Duration of experiment ... days	52	52
Total weight:		
Initial ... pounds	587	581
Final ... do	1,082	1,070
Average daily gain ... do	1.19	1.17
Yield per acre (estimated) ... bushels	50	50
Tankage consumed ... pounds	.....	37
Estimated corn fed per pound of gain ... do	5.66	5.72

The results indicate that the addition of tankage to the ration was of no value in increasing the rate of gain or in reducing the corn consumed per unit of gain.

PASTURING EXPERIMENTS.

PASTURING SHEEP.

A pasture carrying-capacity test with sheep was begun in 1919. The pasture used in this test contained 1.4 acres and was seeded to white clover and bluegrass, one half in 1913 and the other half in 1918 (fig. 4). The pasture was divided and the sheep alternated

from one pasture to the other every 10 to 14 days, as the pasture required. The number of sheep varied during the season, enough sheep being kept to consume all of the pasture. The first ewes and their lambs were placed on pasture on May 11, and the last lambs removed on October 4. During the season of 146 days an average of five ewes and nine lambs were carried per acre of pasture. Calculated to a standard basis, the ewes gained 96 pounds and the lambs 424 pounds from each acre pastured.

PASTURING EXPERIMENTS WITH DAIRY COWS.[1]

A pasturing experiment with dairy cattle to determine the carrying capacity of three pasture mixtures which was conducted in 1918

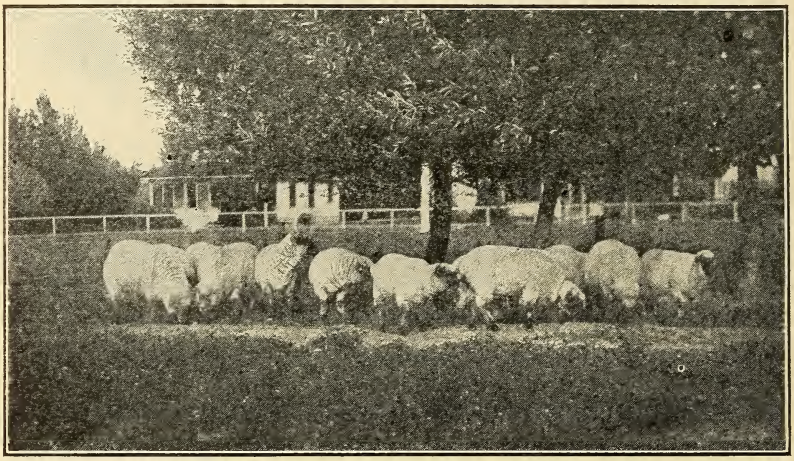

FIG. 4.—Sheep on pasture consisting of bluegrass and white clover on the Huntley Experiment Farm in 1919.

was continued in 1919. The mixtures used in this test and the rate of seeding of each of the grasses and clovers in the mixtures were as shown in Table XX.

TABLE XX.—*Pasture mixtures and rates of seeding in a carrying-capacity test with dairy cattle on the Huntley Experiment Farm in 1919.*

Pasture mixtures.	Rate per acre of seeding (pounds).		
	Mixture No. 1.	Mixture No. 2.	Mixture No. 3.
Awnless brome-grass	2	2	.....
Orchard grass	5	5	5
Tall fescue	3	3	3
Perennia lrye-grass	3	3	.....
Kentucky bluegrass	4	4	4
White clover	2	.....	2
Alsike clover	2	.....	2
Seed per acre	21	17	16

[1] This report was prepared by Mr. J. B. Shepherd, who was detailed by the Dairy Division of the Bureau of Animal Industry to have charge of the work with dairy cattle.

These pastures were seeded in 1916 and cut for hay in 1917. There were 2 acres of each pasture mixture, and the pastures in each case were divided.

Since the number of cows in the herd was limited, not enough cows in milk were available for all the pasture experiments, and some of the cows in each lot were dry during the course of the experiment. The cows in milk were divided into as nearly equal lots as was possible with respect to the length of the lactation period, previous and present production, weight, and date of next calving.

In 1918 the cows were not placed on pasture until May 22, and a crop of hay was harvested from the pastures before the pasturing experiment was begun. The pasture period for mixtures Nos. 1 and 3 extended to October 12, or a total of 144 days. The cows on pasture mixture No. 2 were removed on October 2 because of short pasturage, so that the pasture period on this mixture was only 134 days. Three cows were placed on each mixture at the beginning of the test. A fourth cow was added to each group on June 10, as it was found that three cows could not keep the pastures grazed closely enough. They were removed on August 23, only three cows remaining in each group after that date.

Two cows on mixture No. 1 were producing milk during the entire pasture season, but the third cow was dry throughout the season. The fourth cow, which was placed on each mixture from June 10 to August 22, was a dry cow in each case. On mixture No. 2 there were three milking cows, but they were taken from pasture and from the experiment 10 days earlier than were those on mixtures Nos. 1 and 3. On mixture No. 3 two cows were milking part of the season; the third was dry.

In 1919 the cows were placed on pasture on May 8, four cows in each group. One cow was removed from mixtures Nos. 1 and 2 on June 23 and one from mixture No. 3 on June 25. The three cows remaining in each group were carried on the pasture for the remainder of the pasture season with the exception of one week beginning July 9, when they were all removed to allow the pastures to recover from too close grazing. The pasture season extended to September 28, a total of 141 days.

All four cows on each mixture were milking at the beginning of the pasture season. Of the three cows which were on mixture No. 1 during the entire season, two continued to milk until they were taken off pasture, while the third cow went dry on September 10. Two of the three cows on mixture No. 2 were milking throughout the season, while the third cow was dry on August 13. Two cows on mixture No. 3 milked throughout the season, the third going dry on August 13. The cow removed from each mixture the latter part of June was milking during the time she was on the experiment.

The pastures in each part of the experiment were divided and each part pastured alternately for periods of five days to two weeks, de-

pending upon pasturage conditions. Each part of the pasture was irrigated soon after the cows were removed to the alternate pasture until early in September.

Table XXI gives the results per acre obtained from each of the three mixtures in 1918 and 1919.

TABLE XXI.—*Results of pasturing experiments with dairy cows on the Huntley Experiment Farm in 1918 and 1919.*

Items of comparison.	Mixture No. 1.		Mixture No. 2.		Mixture No. 3.	
	1918	1919	1918	1919	1918	1919
Length of grazing season.....days..	144	141	134	141	144	141
Grazing period per acre.....do....	202	216.5	197.4	216.5	207	217.5
Alfalfa hay fed while cows were off pasture.....pounds..	1,475	536	1,115	513	1,530	542
Average daily number of cows per acre....	1.402	1.535	1.352	1.535	1.444	1.543
Average gain in weight per cow during season (three cows in each case).pounds..	115	125.6	64	39.2	44	112.3
Milking period per acre.....days..	159.5	227.5	201	213.5	85	214.5
Production per acre:						
Milk.....pounds..	3,016.2	4,527.8	4,041.6	3,789.5	2,587.8	3,993.9
Butter fat.....do....	105.04	168.05	129.96	137.61	83.95	128.62
Skim milk.....do....	2,666.3	3,967.4	3,609.1	3,330.8	2,308.3	3,570.2
Hay.....do....	2,674	.....	2,140	.....	1,278	.....
Values per acre:						
Butter fat.....	$44.94	$90.58	$53.86	$74.17	$36.80	$69.33
Skim milk.....	13.33	19.83	18.05	16.65	16.65	17.85
Total of butter fat and skim milk...	58.27	110.41	71.91	90.82	48.34	87.18
Hay at $15 per ton.....	20.05	.....	16.05	.....	9.58	.....
Total of butter fat, milk, and hay.....	78.32	.....	87.96	.....	57.92	.....
Hay fed ($15 per ton in 1918; $20 per ton in 1919).....	11.06	5.36	8.36	5.15	11.47	5.42
Net returns per acre.....	67.26	105.05	81.60	85.67	46.45	81.76

The number of grazing days denotes the total number of 24-hour days that the cows were pastured on each acre.

The number of milking days denotes the number of 24-hour days that the cows in milk were on the experiment.

The value of the butter fat was computed at the actual average price received in each case, being, in 1918, 42.8 cents per pound for cows on pasture mixture No. 1; 41.44 cents for those on mixture No. 2; and 43.82 cents for those on mixture No. 3. In 1919 the average price received in each case was 53.9 cents per pound. Skim milk was uniformly valued at 50 cents per 100 pounds.

The cows were off pasture during stormy weather, when pastures were short, or on account of injury to a cow, and at night after August 28, 1918, and September 14, 1919. It was during these periods that the hay noted in the above table was fed.

The large net income per acre received from pasture mixture No. 2 in 1918, which was $81.60 as compared with $67.26 for mixture No. 1 and $46.45 for mixture No. 3, was undoubtedly due to the longer period that the cows in milk were on that pasture mixture.

In 1919 the results from the different pasture mixtures were more nearly the same, corresponding closely with the number of milking

days per acre. Since the number of milking days was larger in 1919 and butter fat had a greater value per pound, greater returns resulted in each instance over 1918. While the average number of cows per acre was practically the same on all of the mixtures, it was apparent from observation that the amount and growth of the pasture on mixtures Nos. 1 and 3 were greater than for mixture No. 2, and it was evident that the addition of a small proportion of clover increased the production of the pastures. Mixture No. 1 appeared to have a slight advantage in growth over mixture No. 3, indicating that brome-grass is a valuable addition in a pasture mixture.

CARRYING CAPACITY OF AN ACRE OF IRRIGATED PASTURE.

An experiment to determine the maximum carrying capacity of an acre of mixed-grass pasture was conducted in field A, on 1 acre of pasture seeded to mixture No. 1, already described. This pasture was seeded in 1916 and was top-dressed with manure in 1917 and 1918. The pasture was divided and each part pastured alternately in periods of 5 to 10 days. The pasture season began on May 8 and closed on September 28, a period of 141 days. Two cows were carried on this acre throughout the season with the exception of one week beginning July 9, when they were removed because of too close grazing. Four cows were used on this experiment during the summer. Of the two cows (Nos. 204 and 218) placed on the experiment on May 8, No. 204 was removed on July 23, being replaced by cow No. 216 three days later. Cow No. 218 was removed on September 11, being replaced by cow No. 215 on that date. With the exception of one week beginning July 17, when cow No. 218 was dry, the cows were all giving milk during the time they were on the experiment. Cow No. 204 gained 9 pounds while on the experiment; cow No. 218 gained 40 pounds, and cow No. 216, 31 pounds. Cow No. 215 was on the experiment only 18 days and lost 17 pounds during that period. The carrying capacity proved to be greater than that of the pastures used in the pasture-mixture experiment. Table XXII gives the results obtained in this test.

TABLE XXII.—*Results of the maximum carrying capacity of an irrigated pasture on the Huntley Experiment Farm in 1919.*

Items of comparison.	1919	Items of comparison.	1919
Length of grazing season.....days..	141	Values per acre:	
Grazing period per acre.....do....	255	Butter fat.....	$100.40
Alfalfa hay fed while cows were off pasture.....pounds..	768	Skim milk.....	26.64
Average daily number of cows per acre..	1.808	Total of butter fat and skim milk.	127.04
Milking period per acre.....days..	275		
Production per acre:		Value of alfalfa hay fed, at $20 per ton...	7.68
Milk.....pounds..	5,992.5	Net returns per acre of pasture.....	119.36
Butter fat.....do....	199.12		
Skim milk.....do....	5,328.8		